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COST KEEPING FOR SMALL METAL MINES

BY

J. C. PICKERING

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COST KEEPING FOR SMALL METAL MINES.

By J. C. Pickering.

INTRODUCTION.

The importance of keeping accurate accounts of costs at small or medium sized mines is not as well recognized as it might be. This report outlines methods of cost keeping suitable for metal mines of small or moderate size and presents various forms and cost sheets that have been found useful in actual practice. The report is published by the Bureau of Mines in the hope that it will be of help to mine owners and operators who have had difficulty in working out a satisfactory system of cost keeping, and will be of interest to the industry in general. The methods and forms herewith submitted are modifications of practice at mines with which the writer has been connected.

ACKNOWLEDGMENTS.

Acknowledgment is due Messrs. H. Foster Bain, George S. Rice, and R. R. Hornor, of the Bureau of Mines for helpful suggestions and criticism which have added to the value of this report. Acknowledgment is also due to mine owners and operators who supplied information or permitted examination and use of their records.

IMPORTANCE OF SUITABLE COST RECORDS.

To obtain the greatest benefit from mining an operator must, among other things, have a clear, accurate statement of his expenditures and income. This will entail the installation of a suitable accounting system supplemented by cost sheets and contributory data.

From the small independently owned "one-man" mine, where profit and loss are determined solely by the bank balance, to the large mining corporation employing the best technical advice, with accounting and cost keeping executed in great detail, there is a wide transition.

A suitable and properly applied scheme of cost keeping will show, within limits determined by the size and complexity of the mining enterprise under consideration, the proper allocation of all operating and construction expenditures and will enable the management to know at periodic intervals the cost of any particular item. Such information may aid largely in any general campaign of cost cutting or in the elimination, as unpayable, of certain phases of the work.

Adequate and suitable cost-keeping methods are a direct corollary to efficient management. Both contribute largely to the success of any mining enterprise, and when combined they frequently turn failure into success. It is inconceivable that a manager can trace and promptly stop financial leaks unless he knows the detailed cost of the various operations that enter into the aggregate expenditure.

Both cost and financial statements may be so padded with insignificant details as to obscure the main issues. A cost statement applicable to all types of mines is not possible, but skeleton suggestions that may be modified to suit the requirements of individual properties can with some confidence be offered.

A mine that has no transportation difficulties and whose product is marketable without mechanical or other treatment should present the simplest accounting and cost-keeping problem. In contrast to this the property whose ores are complex, or distinct in type, requiring several methods of treatment, may present a difficult problem, which may possibly be further complicated by involved methods of disposing of the final mine products; this type of mining enterprise might require an elaborate system of cost sheets and accounts.

Too much stress can not be laid on the necessity for properly systematizing accounts and costs during the development and equipment stages of mining properties. The information so gathered will prove valuable and necessary not only during its period of execution, but also during the life of the mine.

During the period preparatory to production, mine reserves and surface stock piles may be created, or work such as stripping, which may subsequently be a direct charge against ore extraction, may be done. The cost of doing this preparatory work should be known in order that it may be subsequently charged against ore mined.

EXAMPLE TO INDICATE NECESSITY FOR ADEQUATE ACCOUNTING.

For example, assume that a mining company's total outlay, ignoring a balance of cash assets, is $300,000 when production begins. For the sake of brevity assume that by consolidating the accounts, it is found that this money was spent as follows:

Purchase of property	$50,000
Equipment of property, including supplies	120,000
Development of mine[a]	100,000
Ore breaking[a]	30,000
Total	300,000

---

[a] "Ore breaking" in particular and possibly "development" could properly be carried as a deferred operating account, as distinct from capital charges.

Also, suppose that as a result of this expenditure the company is a going, profitable concern with ore broken in stopes plus reasonably assured ore reserves estimated at 100,000 tons. It will simplify matters to assume that the cost of developing these reserves was the above set forth figure of $100,000, or $1 per ton. The cost of breaking ore, if the $30,000 expended for this purpose has yielded, say, 10,000 tons of ore broken in the stopes and ready for loading, is $3 per ton. The broken ore has thus far cost $4 per ton and the remaining reserves $1 per ton. As this broken ore is removed or the developed ore is mined these charges should be transferred to the operating account, and the deferred expense account correspondingly credited. Otherwise the mine will show a fictitious profit. The above example is simple in the extreme and is capable of almost indefinite elaboration, but it indicates the necessity for adequate, systematic accounting and cost keeping during all stages of preparation, equipment, and operation.

THE APPLICATION OF A COST-KEEPING SYSTEM.

SPECIMEN COST STATEMENT.

To illustrate the application of a cost-keeping system to small or medium-sized mines the following example is given: A supposititious lead-silver mine of moderate size, situated in a western State, and having railroad communication, works a fissure type of deposit by the shrinkage stoping system. The mine run of ore is concentrated by simple jigging. The resultant lead concentrates are sold f. o. b. railway cars at the mine under a long-time contract. The property is well equipped. All accounting is done at the mine and there is no head office. A specimen cost sheet for such a mine is submitted in Form 1. The main cost headings are ore breaking, development, shaft sinking (which comprise the total cost of mining), milling, power, and overhead.

FORM 1.—*Specimen cost sheet*

AMERICAN

Dry tons milled ....

	Per ton milled.	Labor.	Supplies.	Total.
Ore breaking:				
Drills and drilling				
Compressed air				
Explosives				
Tramming				
Hoisting				
Pumping				
Timbering				
Track, pipe lines				
Tools, illuminants, sundry supplies				
Total				
Development:				
Drills and drilling				
Compressed air				
Explosives				
Tramming				
Hoisting				
Pumping				
Timbering				
Track, pipe lines				
Tools, illuminants, sundry supplies				
Total				
Shaft sinking				
Total mining				
Milling:				
Ore bins, breaking and conveying				
Crushing				
Elevating, classifying				
Motors, line shafts, and drives				
Jigging				
Loading concentrates				
Disposal of tailings, and damages				
Water supply				
Mill heating				
Total milling				
Power:				
Fuel				
Operating power plant				
Repairs and renewals				
Miscellaneous supplies				
Total power				

suitable for a small metal mine.

MINING CO.

Statement of costs for the month of............191...

	Per ton milled.	Labor.	Supplies.	General.	Total.
Overhead:					
Administration					
General office expense					
Sampling, assaying, and surveying					
Camp and building maintenance					
Legal expense					
Insurance					
Taxes					
Total overhead					

SUMMARY.

	For month.		Year to date.	
Operating:				
Dry tons milled				
Dry tons concentrates produced				
Dry tons hoisted and sent to mill				
Dry tons broken in stoping				
Dry tons from development				
Feet—Development				
Feet—Shaft sinking				
	Total.	Per ton milled.	Total.	Per ton milled.
Expenses:				
Ore breaking				
Development				
Shaft sinking				
Milling				
Power				
Overhead				
Total expenses				
Value of product				
Operating profit				

Under each of these main headings, with one exception, there are appropriate subdivisions—the exception being shaft sinking. This account is so handled for two reasons: (*a*) The work is frequently contracted and payment is consequently consolidated, (*b*) at many mines the annual amount of shaft sinking may be completed in two to four months—usually the dry season—but the cost of the work (either anticipated or deferred) should be distributed over the cost sheets of the entire year; otherwise they will lose their value from a comparative standpoint. However, if neither of these statements should apply, the main heading, "shaft sinking," may be subdivided in an appropriate manner.

The cost of the various subitems is distributed between labor, supplies, and general—or such of these as apply. All operating expenditures are made up of either labor or supplies or both. "General" applies only to such "overhead" items as telegraph, legal expense, insurance, taxes, etc.

On a small property where no great detail is necessary this form of cost statement will give the necessary information. The statement may be greatly elaborated or it may be supplemented by auxiliary departmental statements, to be discussed later.

For the purposes in hand it is intended that this cost statement shall be considered as a condensed compilation of all expenditures incurred in operating the property. Into the statement all auxiliary statements and contributory data will automatically drain. The success of the entire scheme hinges on this word automatic; otherwise there will be much duplication of work.

To devise a system of cost keeping applicable to mines in general is an impossibility. The most that can be done is to submit general schemes capable of adaptation to specific mines, and if the cost statement shown offers helpful suggestions along those lines it will have served its purpose.

DISCUSSION OF ACCOUNTS SHOWN IN COST STATEMENT.

A brief discussion of some of the principal items that make up this cost statement (Form 1) may prove helpful.

As before stated, mining is broadly subdivided into ore breaking, development, and shaft sinking. These are distinct operations and should be recognized as such, and all preliminary data must be arrived at with this object in view.

Ore breaking is what the name implies. Development is work done for the purpose of discovering new ore, opening up ore bodies already partly exposed, and generally preparing the mine for ore breaking. Shaft sinking, where applicable, anticipates or contributes to development. The point at which a development charge ceases and ore breaking begins must be determined at each property.

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It is possible purposely or unknowingly to make an absolutely fictitious showing by methods of improper classification. Ore reserves must be created and maintained or the financial condition of the mine is insecure. This can only be done by development in some manner. Development may include mine openings, such as drifts, crosscuts, and raises; also diamond or churn drill holes, etc. Development is therefore, for the purposes of condensation, here treated in a general sense. The development statement may be greatly subdivided. In any event judgment must be used to have the mine statements reflect a true state of affairs.

The distinction between ore breaking and development must be determined at each property; in some respects it may be arbitrary. There should be no confusion as to what constitutes shaft sinking.

As before stated, the annual cost of shaft sinking can, with advantage, be anticipated or treated as a deferred charge and distributed over the monthly cost statements with an adjustment at the end of the year or whenever necessary.

Both ore breaking and development are similarly subdivided; therefore, if the items under ore breaking are discussed, those under development should be clear.

Shaft sinking may absorb a part of some or all of the subitems to be discussed under ore breaking, but in order that the explanation may not be too involved, shaft sinking is assumed to be temporarily suspended; if it were not suspended, the method of determining the charge should be apparent from the explanations that follow.

ORE BREAKING.

DRILLS AND DRILLING.

These two items will include (*a*) labor required to run the drills and keep them in repair, steel nippers, steel sharpeners, etc.; and (*b*) drilling oil, material for repairs and for renewals to drills, hose, tanks, columns, steel and all accessories, tool-sharpening supplies, etc. At some mines a portion of the foregoing expense is arbitrarily distributed between ore breaking and development, depending on the number of drills chargeable to each of these accounts, but the wages of the drill runners and helpers should be properly distributed from the time cards.

COMPRESSED AIR.

Under Form 1 the main charge against compressed air is included in the power account. A remedy for this is offered in a subsequent page. Therefore the compressed-air account, as submitted here, merely includes the charge for labor in running and repairing the compressor, that for oil, grease, and waste, and that for repair materials. These charges may be distributed between ore breaking and development on the basis of the number of drills per shift doing each kind of work.

EXPLOSIVES.

The explosives charge includes the cost of dynamite, fuse, and blasting caps. The cost of delivering them to the working faces may also be included when special labor is required for that purpose. There should be a clear-cut distribution of this charge between ore breaking and development obtainable from daily explosives reports. (See Form 24, p. 39.)

TRAMMING.

The tramming account should include labor required for tramming and the labor and supplies necessary to repair and maintain the tram cars; also oils and grease. In addition this account will probably include loading and dumping the cars (see also remarks under "Track, pipe lines"). It may be distributed according to the number of cars trammed from the ore-breaking or the development working faces.

HOISTING.

The hoisting account includes charges for labor and supplies necessary to conduct hoisting, including wages of cage riders, etc.; likewise labor and supplies necessary to repair and maintain the hoist and appurtenances, rope, cage, and shaft or slope. The power account, under Form 1, absorbs the charge for power consumed in hoisting. The cost of hoisting can be distributed between ore breaking and development on the basis of tonnage raised.

PUMPING.

The pumping account comprises charges for the labor and supplies necessary to operate, repair, and maintain the pumps and immediate accessories. The power account absorbs the cost of power consumed in pumping. The distribution between ore breaking and development of the cost of pumping is likely to be arbitrary.

TIMBERING.

The timbering account represents the cost of labor and supplies (see Form 23, on p. 39) necessary to prepare, deliver, place, maintain or renew timber. The purposes for which the work is done will usually determine its distribution to ore breaking or development.

TRACK, PIPE LINES.

This account represents the charge for labor and supplies necessary to extend and maintain the track and a similar charge for extension and upkeep of pipe lines. These two items are thus grouped because in small mines the same crew may attend to both. If either item completely overshadows the other in point of monetary importance a separation had better be made. The distribution of this expense to ore breaking and development will in a measure be arbitrary and judgment should be used. For instance, a long development drift may, after equipment with pipe and track, be abandoned through failure to find ore, the materials being removed and used elsewhere. Due weight must be given to situations such as this. The extension and maintenance of tracks is properly a tramming charge. If a track crew is regularly employed on the work this account may be included under tramming.

TOOLS, ILLUMINANTS, AND SUNDRY SUPPLIES.

Relatively speaking, these three items are not usually important. Unless a specific charge is cheaply obtained then they may be arbitrarily distributed.

OTHER CHARGES.

In addition to the foregoing items there are charges which must be arbitrarily distributed not only between the ore breaking and the development accounts but also among the subdivisions of these accounts.

The preceding statement refers particularly to the wages of the mine superintendent, mine foremen, and shift bosses. A distribution as follows might be found advisable:

Ore breaking	60 per cent.
Development	40 per cent.

or

Ore breaking	50 per cent.
Development	30 per cent.
Shaft sinking	20 per cent.

with a further redistribution as follows:

Drills and drilling	50 per cent.
Tramming	10 per cent.
Hoisting	5 per cent.
Pumping	5 per cent.
Timbering	20 per cent.
Track, pipe lines	10 per cent.

At some properties the salary of the general manager and the expenses for surveying and assaying are appropriately distributed to departments and redistributed to subitems. This is a matter of judgment.

The allocation of the time of the mechanics and helpers should show on their time cards. The cost of operating a machine shop, if any, may be fairly distributed by work cards or by methods which will suggest themselves. This is subsequently discussed.

MILLING.

The general scheme of distributing the mill expense to its respective subheadings follows, in a general way, the outline given under "Ore breaking." If the data that drain into the final cost sheet are in order there will be no confusion.

POWER.

See explanation under "Milling."

OVERHEAD CHARGES.

The account for overhead charges covers what the name implies. The subitems into which it is divided are briefly discussed here.

ADMINISTRATION.

The administration account includes administrative salaries, expense accounts, etc., not absorbed by other departments.

GENERAL OFFICE EXPENSE.

The account for general office expense covers the cost of conducting the general offices—it will include salaries of clerks, cost of stationery, telephone, and telegraph, postage, cost of office upkeep, etc.

SAMPLING, ASSAYING, AND SURVEYING.

The sampling, assaying, and surveying account includes the cost of all labor and supplies incurred for these purposes. It is sometimes distributed departmentally.

MAINTENANCE OF CAMP AND BUILDINGS.

This account is self-explanatory. Frequently repairs and renewals (maintenance) to buildings are departmentally subdivided.

LEGAL EXPENSE.

The legal expense account is self-explanatory. Note under milling (Form 1) that provision is made for damages incurred in disposal of tailings.

INSURANCE.

The usual types of insurance carried are fire, boiler explosion, and employer's liability. Insurance against loss of profits through fire or explosion is sometimes carried. The annual cost of all premiums, except employer's liability, is known and one-twelfth of this amount should be charged to each month's operations. Employer's liability is usually calculated on the pay rolls and this can be accurately determined and charged monthly.

TAXES.

The tax charges are not always known in advance, in which event they should be estimated and prorated monthly.

FURTHER DISTRIBUTION OF SPECIAL ACCOUNTS.

The foregoing covers in a brief way the general method of procedure to be followed in this particular type of simple cost sheet. The writer has by no means attempted to cover the multitude of contingencies which may arise but rather to submit a skeleton suggestion. Each mine presents its own problem and judgment must be used. For instance from time to time extra or unusual expenses may be incurred. An expensive hoisting rope or costly roll shells, crusher parts, etc., may be found necessary. The cost of these should be distributed over the cost sheets of a reasonable number of months, otherwise the value of the cost statements will, for comparative purposes, be greatly impaired.

It will have been noticed that no provision is made for mine warehouse expense. This is treated as a clearing account by methods subsequently explained on pages 21 to 29.

If a boarding or bunk house is conducted at a loss it is a proper charge against operations and would probably be included under labor and distributed pro rata.

At most mines much work can be advantageously done by contract, such work for instance as drilling per foot of hole, mining, or tramming per car of ore, developing or shaft sinking per linear foot, etc. This feature is discussed later. When contracting becomes an item of importance it may be differentiated from company work on the cost sheet. (See also Form 19, on page 34.)

POWER.

For the sake of simplicity the cost of power has, in the forms so far submitted, been treated as a departmental charge divided into subitems, because at many small mines the correct apportionment of this charge to the various units of consumption is not obtainable. However, unless we know the cost of power consumed in compressing air, hoisting, pumping, etc., we can not know the cost of mining, and a similar statement is applicable to milling. To distribute power we must know the consumption per machine together with transmission losses. This may be obtained by meter readings at electrically equipped mines or by calculation at mines having steam-driven units. If the figures so obtained are not reasonably accurate they are worthless.

COST SHEET ADAPTED TO DISTRIBUTION OF POWER CHARGES.

If the cost of power is to be distributed it must be treated as a clearing account. Form 2 shows the original cost sheet (Form 1) adapted to distribute power charges to the various units of consumption. For purposes of demonstration operating figures have been inserted. It will be noted that shaft sinking amounts to $817.66. This is the November proportion of the cost of shaft sinking during 1918. The annual footage necessary had been completed earlier in the year.

FORM 2.—*Specimen cost sheet show*

AMERICAN

Dry tons milled, 4,000.

	Per ton milled.	Labor.	Supplies.	Power.	Total.
Ore breaking:					
Drills and drilling	$0.966	$3,408.39	$456.57		$3,864.96
Compressed air	.288	101.25	77.62	$974.47	1,153.34
Explosives	.224		895.02		895.02
Tramming	.359	1,257.80	176.32		1,434.12
Hoisting	.139	316.33	22.16	218.25	556.74
Pumping	.035	72.16	37.21	32.48	141.85
Timbering	.214	614.34	241.16		855.50
Track, pipe lines	.148	113.76	477.86		591.62
Tools, illuminants, sundry supplies	.045		181.16		181.16
Total	2.418	5,884.03	2,565.08	1,225.20	9,674.31
Development:					
Drills and drilling	.610	2,213.88	226.16		2,440.04
Compressed air	.152	77.16	43.21	487.23	607.60
Explosives	.183		731.64		731.64
Tramming	.175	616.12	84.40		700.52
Hoisting	.088	231.08	15.21	104.47	350.76
Pumping	.019	39.52	19.64	15.00	74.16
Timbering	.092	208.36	161.90		370.26
Track, pipe lines	.047	71.44	118.11		189.55
Tools, illuminants, sundry supplies	.025		101.30		101.30
Total	1.391	3,457.56	1,501.57	606.70	5,565.83
Shaft sinking	.204				817.66
Total mining	4.013				16,057.80
Milling:					
Ore bins, breaking and conveying	.202	287.51	76.80	445.07	809.38
Crushing	.251	314.20	116.31	575.16	1,005.67
Elevating, classifying	.044	51.16	46.50	76.81	174.47
Motors, line shafts and drives	.005	11.21	9.34		20.55
Jigging	.070	211.16	9.36	59.40	279.92
Loading concentrates	.046	96.74	21.60	64.12	182.46
Disposal of tailings, and damages					
Water supply	.029			116.71	116.71
Mill heating	.027	31.16	76.40		107.56
Total milling	.674	1,003.14	356.31	1,337.27	2,696.72

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ing distribution of power charges.

MINING CO.

Statement of costs for the month of November, 1918.

	Per ton milled.	Labor.	Supplies.	Power.	General.	Total.
Overhead:						
Administration	$0.128	$513.16				$513.16
General office expense	.112	373.82	$31.60		$41.17	446.59
Sampling, assaying and surveying	.096	313.04	70.08	2.08		385.20
Camp and building maintenance	.038	64.16	88.00			152.16
Legal expense	.025				100.00	100.00
Insurance	.128				512.00	512.00
Taxes	.125				500.00	500.00
Total overhead	.652	1,264.18	189.68	2.08	1,153.17	2,609.11

SUMMARY.

	For month.	Year to date.
Operating:		
Dry tons milled	4,000	41,120
Dry tons concentrates produced	764	7,820
Dry tons hoisted and sent to mill	4,054	41,245
Dry tons broken in stoping	3,642	39,600
Dry tons from development	612	5,460
Feet—developing	360	4,106
Feet—shaft sinking	.....	217

	For month.		Year to date.	
	Total.	Per ton milled.	Total.	Per ton milled.
Expenses:				
Ore breaking	$9,674.31	$2.418	$90,875.28	$2.21
Development	5,565.83	1.391	51,811.20	1.26
Shaft sinking	817.66	.204	8,635.04	.21
Milling	2,696.72	.674	23,438.50	.57
Overhead	2,609.11	.652	24,672.12	.60
Total expenses	21,363.63	5.339	199,432.14	4.85
Value of product	26,216.80	6.55	296,886.40	7.22
Operating profit	4,853.17	1.21	97,454.26	2.37

EXAMPLE ILLUSTRATING ALLOCATION OF POWER CHARGES.

Illustrating the allocation of power charges, the following is from a mine equipped in part with internal-combustion oil engines and in part electrified.

Cost and distribution of electric light and power.

Debits:	
Superintendence	$67.50
Wages—operation	772.99
Fuel oil	2,794.64
Oils and waste	150.12
General supplies	220.36
Wages—repairs and renewals to engines (includes mechanical department charges)	117.79
Material—repairs and renewals to engines (includes mechanical department charges)	263.92
	4,387.32
Credits:	
Mining department (redistributed)	1,180.55
Milling department (redistributed)	2,490.51
Machine shop	8.00
Assay office	2.32
Office	.13
Drafting	.13
Rooming, boarding house, and dwellings	3.62
Surface	2.06
	4,387.32

MECHANICAL DEPARTMENT.

As the mine grows, a considerable mechanical department with good sized shops, etc., may be developed. In such event the distribution of costs may be facilitated by making the charge to this department a clearing account; the cost of this department would be appropriately distributed on a labor or piecework basis to the department for which the work is done. It is therefore absorbed and does not appear distinctively on the cost sheet.

DISTRIBUTION OF POWER AND OTHER CHARGES WHEN MECHANICAL ACCOUNT IS KEPT.

On the foregoing basis, where clearing accounts are established for both power and the mechanical department it will be obvious that there is a close relation between the two. The power plant will be under the charge of the master mechanic and should be debited with a portion of his salary—likewise the shop will take power and a proportionate charge must be made. Power shows on the cost sheet (see Forms 1 and 2) as a distinct item, whereas the mechanical department does not so appear. The wages of mechanics and the supplies used by them will show daily on the work cards and requisitions, and be charged direct to the job for which the work is done. The machine-shop overhead charges such as cost of power, heat, light, repairs, and renewals to shop and contents, and wages not capable of exact distribution will be prorated monthly to the mining, milling, and other departments on the basis of the proportion of the mechanics work cards chargeable to each of these departments, or by some other appropriate means. By way of illustration the example showing allocation of power charges may be extended as follows:

Cost of machine-shop overhead charges.

Debits:

Superintendence	$90.00
Power	8.00
Wages, repairs, and renewals	3.15
Material	10.01
New tools and sundry supplies	16.91
	128.07

Credits:

See preceding explanation.

SPECIMEN DEPARTMENTAL COST SHEET.

As previously stated, departmental cost sheets are frequently desirable; they may supplement or be used independently of the main cost statement (Forms 1 and 2). An example of such a departmental cost sheet is submitted in Form 3—for purposes of demonstration some operating figures have been inserted. It will be noted that Form 3 supplies more detail than does Forms 1 and 2 but its items can be rapidly consolidated to drain into those forms. Form 3 shows the detailed cost of shaft sinking done during the month covered by the figures.

FORM 3.—*Specimen cost sheet showing distribution of expenditures for shaft sinking.*

AMERICAN MINING CO.

Mining Department.

Costs for month of July, 1913.

Dry tons broken in stoping, 3,981.
Dry tons from development, 687.
Dry tons hoisted and sent to mill, 4,456.

	Ore breaking.	Development.	Shaft sinking.	Total.
Mining.				
Labor (operating and repairs):				
Superintendence, foreman, shift bosses	$355.50	$213.30	$142.20	$711.00
Drilling	3,192.55	2,060.60	2,816.30	8,069.45
Tramming	1,061.80	592.43	....	1,654.23
Timbering	583.50	216.24	313.41	1,113.15
Track and pipe lines	157.90	62.18	21.16	241.24
Tool nippers	43.42	33.60	19.22	96.24
Compressor	181.14	142.72	98.30	422.46

Form 3.—*Specimen cost sheet showing distribution of expenditures for shaft sinking*—Con.

AMERICAN MINING CO.—Continued.

Mining Department—Continued.

	Ore breaking.	Development.	Shaft sinking.	Total.
Mining—Continued.				
Supplies:				
Drill steel, oil, and drill connections	$218.08	$141.60	$72.20	$431.88
Repair parts for drills and new drills	317.21	118.22	61.31	496.74
Compressor supplies and repairs	51.20	30.39	24.80	106.39
Pipe lines—new and repairs	231.47	94.43	41.30	365.20
Track—new and repairs	316.44	38.16		354.60
Tram cars—new and repairs	121.30			121.30
Explosives	1,095.02	931.89	517.23	2,544.14
Timber	207.92	135.13	318.31	661.36
Tools and sundry supplies	29.77	40.31	16.84	86.92
Illuminants	140.85	81.60	111.14	333.59
Total	8,305.07	4,930.80	4,573.72	17,809.59
Pumping.				
Labor:				
Operating and repairing pumps	65.62	43.74	4.31	113.67
Supplies:				
Oils, grease, and waste	6.35	4.23	5.17	15.75
Repair parts	21.23	14.15	32.81	68.19
Total	93.20	62.12	42.29	197.61
Hoisting.				
Labor:				
Operating and repairing hoist	223.60	134.16	89.44	447.20
Operating and repairing cage, cable, and shaft	152.77	91.66	61.12	305.55
Supplies:				
Oils, grease, and waste	19.86	11.92	7.94	39.72
Repairs and renewals to hoist				
Repairs and renewals to cages, cables, etc				
Repairs and renewals to shaft				
Total	396.23	237.74	158.50	792.47
Blacksmithing.				
Labor:				
Blacksmithing	243.35	189.25	108.15	540.75
Supplies:				
Fuel	60.70	47.22	26.98	134.90
Miscellaneous	4.69	3.65	2.08	10.42
Total	308.74	240.12	137.21	686.07
Summary.				
Mining	8,305.07	4,930.80	4,573.72	17,809.59
Pumping	93.20	62.12	42.29	197.61
Hoisting	396.23	237.74	158.50	792.47
Blacksmithing	308.74	240.12	137.21	686.07
Total	9,103.24	5,470.78	4,911.72	19,485.74
Total development, feet, 396. Total shaft sinking, feet, 92.				

ACCOUNT NUMBERS.

The numbering of accounts will facilitate their handling. It will usually be found advisable to allow for subsequent expansion by leaving blank numbers.

The following numbering scheme is presented as applicable to the suggested cost sheets.

Numbering scheme applicable to cost sheets.

Account No.	
	ORE BREAKING.
	DRILLS AND DRILLING.
1	Labor for operating drills.
2	Supplies for operating drills.
	COMPRESSED AIR.
5	Labor for operating compressor.
6	Supplies for compressor.
	EXPLOSIVES.
10	Labor for delivering explosives.
11	Supplies (explosives).
	TRAMMING.
15	Labor for tramming (and construction of new tracks?).
16	Supplies for tramming.
	(Extend for hoisting, pumping, etc.)
	DEVELOPMENT.
	DRILLS AND DRILLING.
51	Labor for operating drills.
52	Supplies for operating drills.
	COMPRESSED AIR.
55	Labor for operating compressor.
56	Supplies for operating compressor.
	(Extend for explosives, tramming, etc.)

The same scheme may be extended to "shaft sinking" (applying appropriate subdivisions), "milling," etc.

It will be apparent that certain accounts are not capable of immediate distribution. Such for instance are compressed air, hoisting, etc. Therefore: **When using numbers for accounts that are to be redistributed, the "ore breaking" or other "key" numbers are used with the letter R affixed.**

MINE WAREHOUSE.

A mine warehouse is for the purpose of storing and facilitating the distribution of supplies and enabling a correct accounting to be made thereof.

Supplies is an elastic item; for the purposes of this discussion it will include all material from a box of tacks to the heaviest piece of machinery. It will facilitate matters if all supplies come under the supply clerk and are cleared through a "mine warehouse" account regardless of whether they ever enter that warehouse. This will tend to insure their proper distribution. The wages of the supply clerk and his assistants, if any, together with the cost of transportation, teaming, and handling should all be cleared through the mine warehouse and charged against the supplies as issued. Common sense must be used in the distribution of these so-called "warehouse charges." For instance, on large pieces of machinery or on special items, the cost of transportation—which may be considerable—should, as far as practicable, be charged against that particular machine. On the other hand, if a consignment of hardware is received, it might be impracticable to figure the transportation on each article entering into the consignment. At many mines it is found that for practical purposes, on the average material issued from the mine warehouse, once the construction stage is passed or eliminating large pieces of machinery, a general charge of 10 per cent will, if added to the invoice cost, cover the "warehouse charges" plus inventory shortages. As it is assumed that periodic stock inventories will be taken, the factor for warehouse charges can be determined for each mine and adjusted when necessary. Once a good working figure has been obtained its use will save much valuable time.

A well designed mine warehouse with adequate stocks properly arranged will save much time and money; its importance can not be overestimated. Such a warehouse will enable the management to obtain quotations, purchase in quantity, and consequently secure better discounts, will lower the transportation charges by affording opportunity for taking advantage of car-load rates, will eliminate costly telegraphing and much unnecessary expressage with the probability of a much higher price being paid for the articles under such urgent conditions, and will also cut labor charges by having supplies ready for issue as needed.

The carrying of adequate supplies is so frequently ignored, especially on small properties, that it deserves special mention here. At isolated mines the keeping of supplies that are likely to be needed is of special importance. Such provision can, like everything else, be carried to impracticable extremes—the interest on the value of the warehouse contents has to be considered. However, where judgment is used the interest charges will be saved many times over by carrying adequate stocks.

PROCEDURE FOR ROUTINE HANDLING OF WAREHOUSE STOCKS.

At a going mine with supply stocks on hand the following routine may be adopted in replenishing and handling warehouse material:

LISTING MATERIAL NEEDED.

(1) The supply clerk periodically prepares (monthly, as near as possible) a list of material necessary to maintain stocks or for special purposes. On such lists he frequently makes recommendations as to the firms from which such material can most advantageously be purchased, or specifies certain brands—all such notations having regard to quality, price, and delivery. Form 4 is a specimen blank for making such a request for material. Such requests go to the general office or the employee responsible for the proper purchase of material. All purchase orders for material should be approved by the manager before being placed; in making his decision the manager will be governed by the needs of the property, the stock cards, general market conditions, and quotations.

Form 4.—*Specimen blank for requesting supplies needed.*[a]

AMERICAN MINING CO

Oct. 25, 1918.

To the General Manager:
The following supplies are required:

Quantity.	Size.	Brand.	Material.	When wanted	Required for	Suggested that order be placed with—
	Inches.					
500 feet	5		*Black iron pipe*	*Nov. 15*	*Stock*	*Nat'l Hdw. Co.*
1,000 feet	*3*		*do*	*do*	*do*	
1,000 feet	*2*		*do*	*do*	*do*	
10 drums		*"Miner"*	*Carbide*	*do*	*do*	
100 pounds		*No. 2*	*Col'd cotton waste*	*do*	*do*	

[a] Convenient size, 8 by 10½ inches.

Approved:

....
General Manager.

A. B. Carter,
Supply Clerk.

REQUESTS FOR QUOTATIONS, AND ACKNOWLEDGMENT.

(2) Requests for quotations (Form 5) are sent out covering such material needed, unless the mine has covering contracts or unless there are special reasons for not doing so. When received the quotations are entered on Form 6. Much money can be saved by the proper purchase of supplies, which implies the obtaining of quotations. This will entail some work, but at any mine of ordinary size will pay handsomely. Urgent requirements can usually be eliminated by exercising foresight.

Business courtesy usually implies an acknowledgment of a proposal to furnish material. Form 7 is submitted for that purpose.

FORM 5.—*Specimen request for quotations.*[a]

Quotation No. *762*.

AMERICAN MINING CO.

(Give address.)

Oct. 16, 191*8*.

To *National Hdw. Co.,*
Salt Lake City,
Utah.

Please affix the lowest price at which you will furnish the following supplies f. o. b. *Mineville, Utah,* with length of time required to make shipment and your best terms of discount.

The right to accept all or any part or to decline the whole is reserved.

Our vouchers are payable on or about the 20th of the month succeeding that in which goods are received. We pay no drafts except by special arrangement.

No charge is allowed for packing or cartage.

Quantity.	Description.	Price quoted.
500 feet	*4″ Black iron pipe*	
1,000 feet	*3″ Black iron pipe*	
1,000 feet	*2″ Black iron pipe*	
10 drums	*“Miner” Carbide*	
100 pounds	*No. 2 Colored cotton waste*	
	This is not an order.	

Please return this specification at once with prices stated thereon.

AMERICAN MINING CO.
Per *F. B. See.*

---

[a] Convenient size, 8 by 10½ inches.

FORM 6.—*Specimen record for quotations.*[a]

QUOTATIONS.

Article. *Rails—relaying—20 lb. to 30 lb.*

Date.	Name. Address.	Price.	Unit.	Remarks.
2/7/18	*Harper & Co., St. Louis*	*$58.50*	*Ton*...	*F. o. b. St. Louis.*
4/12/13	*Denny Mchy. Co., Denver*.......	*60.00*	...*do*...	*F. o. b. Denver.*
5/9/18	*Argall Bros., Salt Lake City*.....	*57.50*	...*do*...	*F. o. b. Salt Lake City.*

FORM 7.—*Specimen letter of acknowledgment.*[b]

AMERICAN MINING CO.

(Give address.)

.... 191...

To.....................................

....

....

DEAR SIRS: We thank you for your proposal, submitted under date .... 191.., on our request for quotation No. ....

Please be advised that:

A portion—all—of the order will be placed with you.
Order has been placed elsewhere.
Purchase has been postponed indefinitely.

AMERICAN MINING CO.

ORDERS OF MATERIAL.

(3) For the purchase of material, Form 8 is suitable. Open orders should be avoided, see (2). Avoid, if possible, ordering supplies to be sent by express. At properties of fair size all orders for supplies should be entered as made on order cards (see Form 9) provided for that purpose, using a separate card for each class and size of material ordered. When invoices are received the price and f. o. b. point are entered on the card. In this manner a comparison can always be made with previous prices.

---

[a] Cards, convenient size, 4 by 6 inches.

[b] Convenient size, 8½ by 6 inches.

FORM 8.—*Specimen order blank for supplies.*[a]

Order No. 417.

AMERICAN MINING CO.

(Give address.)

July 18, 1918.

To *Sullivan Machinery Co.*,
Salt Lake City, Utah.

Please ship us by *freight* the articles listed below.

On day of shipment mail us two copies of invoices, also bill of lading and packing list showing contents of each box or package.

Unless otherwise arranged, all goods received in one month will be paid for on the 20th of the month following.

We pay no drafts. No charges allowed for packing or cartage.

Quantity.	Description.	Price.
	For DP–33 drills.	
12	*Striking blocks, No. 2788–D*	*$3.85 each.*
3	*Chuck housings, No. 2686–D*	*16.50 each.*
6	*Pistons, No. 2222–D*	*17.50 each.*
12	*Valve bushings, No. 1598–D*	*2.75 each.*
12	*Rifle nuts, No. 2552–D*	*3.85 each.*

Read shipping instructions carefully.

If for any reason you can not make prompt shipment, please advise.

AMERICAN MINING CO.
Per *F. B. See.*

FORM 9.—*Specimen blank for recording order of supplies.*[b]

ORDERS.

Article. *Brick—Common red.*

Date.	Order No.	From.	Quantity.	Date invoiced.	Price.	Remarks.
1/1/18	*278*	*Mountain Brick Co*	*20 M*	*1/20/18*	*$10.20*	**F. o. b. kiln.**
4/7/18	*314*	*McArthur Bros*	*20 M*	*4/22/18*	*10.60*	**Do.**
9/16/18	*461*	*do*	*20 M*	*10/2/18*	*11.40*	**Do.**

---

[a] Convenient size, 8 by 10½ inches.

[b] Cards, convenient size, 4 by 6 inches.

CHECKING AND RECORDING SUPPLIES RECEIVED.

(4) The supplies as received are carefully checked against the invoice, the prices and extensions on the invoice are compared with those on the order, and the original invoice is approved for payment. The material is then either lodged in the warehouse or delivered direct to the point of use. The supply clerk, at the time he approves the invoice issues a charge (Form 10) for use of storage against the department to which it is credited. In this connection see general explanation under "Mine Warehouse" (p. 22) for taking care of charges for transportation and handling special machinery purchases.

Form 10.—*Specimen blank for storage-charge record.*[a]

AMERICAN MINING CO.

Sheet No. *3*. Month of *August*, 191*8*.

No.	Invoice or charge.	Amount.		Charge.				
				Direct.			Warehouse.	
				Account No.	Amount.		Amount.	
	National Co	*917*	*63*	......	......	....	*917*	*63*
	General Electric Co	*79*	*40*	*156*	*79*	*40*	......	....
	McArthur Bros	*216*	*06*	*117*	*216*	*06*	......	....
	Henney Lumber Co	*824*	*30*	*202*	*609*	*71*	*214*	*59*
	S. P. R. R	*813*	*07*	*117*	*19*	*20*	......	....
				206	*61*	*82*	......	....
				162	*41*	*34*	*690*	*71*
Total this sheet								
Total brought forward		*6,218*	*71*	......	*906*	*13*	*5,312*	*58*
Total carried forward								

---

[a] Convenient size, 8 by 10½ inches.

Note.—This distribution may, as an alternative, be shown on back of voucher.

ISSUANCE OF SUPPLIES.

(5) Supplies should be issued only on requisition (see Form 11). This requisition is usually signed by a foreman or other responsible employee, who gives the account for which it is to be used. The supply clerk prices the requisition from the order or stock cards. The withdrawal is then entered on the stock card (Form 12). The supply clerk will daily enter on sheets provided for that purpose (Form 13) all issues using a separate sheet for each account number. The monthly total for each account number gives the invoice cost of all supplies requisitioned for that number. To this total is added

the predetermined warehouse charge (of, say, 10 per cent) to absorb salary of supply clerk, transportation costs, etc., because the "mine warehouse" account is a clearing account charged with all such expenditures and must receive corresponding credits.

FORM 11.—*Specimen blank requisition.*[a]

AMERICAN MINING CO.

REQUISITIONS FOR SUPPLIES.

Req. No. *114.*

The Storekeeper:

Please deliver the following supplies to bearer:

Charge to *Ore-Breaking Drills* A/C No. .... Date, *Sept. 16, 1918.*

Quantity.	Unit.	Article.	Cost.	Extension.
25	*Ft.*......	*½″ water hose*..................	....	
1	*Qt*......	*Machine oil*....................	....	
1	....	*Valve bushing # 1598 D*........	....	

Signed, *Frank Roe,*
Foreman.

FORM 12.—*Specimen blank for recording issuance of supplies from warehouse.*[b]

AMERICAN MINING CO.

WAREHOUSE STOCK CARD.

Article, *Roofing—Prepared # 1.* Unit, *Roll.*

Received.[c]					Issued.				On hand.		
Date ordered.	From whom.	Q'ty.	Price.	Amt.	Date.	Q'ty.	Price.	Amt.	Date.	Q'ty.	Amt.
3/3/18	*Nat'l Hdw. Co.*	*50*	*1.70*	*85.00*	*3/5/18*	*20*	*1.70*	*34.00*	......	....	......
4/10/18	*Reeves Bros....*	*100*	*1.85*	*185.00*	*3/27/18*	*10*	*1.70*	*17.00*	......	....	......
					4/20/18	*40*	*1.83*	*73.20*	*4/21/18*	*80*	*145.80*

---

[a] In pads; convenient size, 3½ by 7 inches.

[b] Cards, convenient size, 5 by 8 inches.

[c] Provision may be made for including transportation and teaming charges, in order to give actual cost f. o. b. warehouse, if desired.

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FORM 13.—*Specimen form for monthly record of supplies issued from warehouse.*[a]

AMERICAN MINING CO.

FOR MATERIAL AND SUPPLIES ISSUED IN MONTH OF *August, 1918.*

TO ACCOUNT NO. *16.*

Date.	Quantity.	Description.	Unit.	Price.	Total.
2	*5 gal*	*Black oil*	*Gal*	*.14*	*.70*
2	*3 lbs*	*Grease*	*Lb*	*.21*	*.63*
9	*1 set*	*Car wheels*	*Set*	*19.75*	*19.75*
10	*1,500 ft*	*Oak lumber*	*M*	*30.00*	*45.00*
15	*10 gal*	*Black oil*	*Gal*	*.14*	*1.40*
15	*5 lbs*	*Grease*	*Lb*	*.21*	*1.05*
20	*1*	*Grease gun*		*.85*	*.85*
25	*10 gal*	*Black oil*	*Gal*	*.14*	*1.40*
25	*5 lbs*	*Grease*	*Lb*	*.21*	*1.05*
		Total			*71.83*

[a] Convenient size, 8 by 10½ inches.

INVENTORIES.

(6) Periodic inventories of warehouse stock must be taken—these may be recorded on the usual inventory sheets which are carried in stock by stationers. The items and totals are checked against the stock records. At well established mines with large stocks inventories may only be made annually; but at smaller mines should be made at more frequent intervals. The inventory and comparisons should from time to time be made by an employee other than the supply clerk.

LABOR.

There are many ways of recording the time of operatives and of making a correct distribution thereof. Accuracy is of the first importance. Frequent mistakes in time keeping cause dissatisfaction amongst employees, some of whom have little or no education. Time-keeping records should be checked at intervals, as pay-roll padding is not uncommon.

IDENTIFICATION RECORDS OF EMPLOYEES.

Many companies keep identification card records of all employees (see Form 14) on reverse of which may be suitable provision for recording reemployment or promotion. These cards are frequently a valuable help.

FORM 14.—*Specimen blank for identification record.*[a]

Name .... Occupation ....

Place and date of birth .... American citizen? ....

Reads, speaks, writes English. (Strike out inappropriate)	Married, single, widower. (Strike out inappropriate)	Number of children ......

Name and address of nearest relative ....

....

Name and address of organization (if any) that will assist you in case of illness or disability ....

Date .... Signed ....

Date left .... Reasons leaving ....

RECORD OF APPLICATION FOR EMPLOYMENT.

Men seeking work usually apply to the foreman for employment. If they are needed, the fact is so stated on a suitable blank (Form 15) and the applicant is referred to the office for purposes of record.

FORM 15.—*Form for application for employment.*[b]

AMERICAN MINING CO.

.... 191 .....

To the Chief Clerk:

The bearer ....

has applied for employment as .... Rate ....

....

Foreman.

METHODS OF KEEPING TIME RECORDS.

Two usual methods of recording time are (*a*) by time books, (*b*) by time cards.

TIME BOOKS.

Time books are kept by the foreman (shift boss) or by a timekeeper who makes the rounds for that purpose, or by both. Time books may cover weekly, monthly or intermediate periods. They usually record in sequence the operative's number, name, occupation, and rate, followed by columnar ruling for his daily and total time. Various styles of time books are usually carried in stock by stationers. The time book should be turned in daily to the office in order that the information may be transferred to the pay rolls and be properly distributed. The designated occupation may not be sufficient for purposes of office distribution, in which event it must be supplemented by other data. Time books do not usually give sufficient detail for large properties.

---

[a] Cards, convenient size 4 by 6 inches.
[b] In pads, convenient size 3 by 5 inches.

TIME CARDS.

Time cards must be devised and adapted to suit the individual requirements of each mine. Where men are regularly employed at one job, as in a mill, a time book may fill the requirements of the situation. In a mine and on surface work it may be necessary to move men from one job to another and time cards are useful; they facilitate office distribution. The time card shown in Form 16 is suitable for underground work. The operative's name, pay-roll number, and rate are filled in during the shift. At the end of the shift the number of hours worked, occupation, and working place are entered. The shift boss signs and dates the card, punches the hours (along top of card to prevent written hours being raised) and also punches the appropriate general distribution, that is, M., D., or S. S. ("Mining," "Development" or "Shaft sinking"). The card is turned in to the time office at the end of each shift. At mines where wages are standardized for various jobs these time cards may be issued in distinctive colors with the hourly rate corresponding to each color printed in bold type thereon.

The distribution of time for mechanics and shop men is usually required in more detail. For keeping such records Form 17 is suitable.

FORM 16.—*Blank time card suitable for recording underground work.*[a]

						○[b]						Over
1	2	3	4	5	6	7	8	9	10	11	12	12

AMERICAN MINING CO.

DAILY TIME CARD.

Rate *4.00*
Name *Frank Hardy.* Number *97.*

Hours.	Occupation.	Working place.	
5	*Tramming*	*5th level—east*	M ○[b]
3	*Mucking*	*Lorimer stope*	D
			S. S.

Will Barkin,
Shift Boss.

Aug. 17, 191*8.*

[No time allowed unless time card is turned in for every shift.]

---

[a] Heavy paper, convenient size 3 by 5 inches.

[b] Punch lobe.

FORM 17.—*Blank record for keeping time of mechanics and shopmen.*[a]

AMERICAN MINING CO.

DAILY SHOP REPORT.

Sept. 3, 191*8*.
Name *Geo. Parker.* No. *61.*

No. hours.	Description of work.	Charge to.
2½	*Adjusting compressor governor*	*Compressor.*
1	*Packing boiler-feed pump*	*Boilers.*
4½	*Installing office lights*	*Gen'l office exp.*

F. M. Gilley, Foreman.

CONTRACT WORK.

At mines where the contract system can be applied, the contracting of much underground work is usually highly desirable. With certain classes of labor, for instance, Mexican, the contract method is especially desirable. In some communities contracting is not advisable.

The contractor usually undertakes to supply and pay for all labor. Such payments are, as a rule, made through the company's office from amounts due the contractor. He is usually permitted to obtain his supplies through the company by using the regular warehouse requisition form. His tools and appliances are usually issued on memorandum receipt, and he is charged for the misuse or loss of these. The contractor's charge for labor and supplies pass through the usual office channels.

A blanket form of mine-contract agreement is submitted in Form 18 herewith. Where applicable such a contract frequently saves disagreement. At mines where contracting is an item of consequence a tabulated report on the work is often found desirable. For that purpose Form 19 is suitable.

---

[a] In pads, convenient size 4 by 7 inches.

FORM 18.—*Blanket form of mine contract.*[a]

FORM OF CONTRACT.

This agreement, made and entered into this *fourteenth* day of *July*, 191*8*, by and between *The American Mining Company*, a corporation hereinafter referred to as the Company, of the one part, and *Luis Cabrera*, hereinafter referred to as the Contractor, of the other part.

Witnesseth:

(1) The Contractor agrees at his own cost and expense to supply and pay for all labor, said payments, however, to be made through the Company's office on the usual pay day in accordance with the rates to be furnished by the Contractor, and shall be chargeable to his account.

(2) The Contractor agrees, subject to the terms and conditions of this agreement expressed and contained, to do work as follows:

Drive 4th level (face now 21 feet east of center chute 416) a distance of 200 feet standard size. Contractor loads and delivers muck to shaft. Contractor to install track and air lines. Company to install timbers if required.

[NOTE: Cover explicitly such items as to who loads and removes the muck; who installs timbers, if any if winzing, who does the hoisting, etc.]

(3) The Company shall at its sole expense furnish and supply the Contractor with tools, timbers, and appliances required by him for the proper carrying out of the said work, and the Contractor shall at his own cost and charge supply and pay for all explosives, illuminants, and other stores required for said work. The Company shall pay the Contractor for such work done by him at the following rate:

Sixteen dollars ($16.00) per lineal foot.

(4) The Contractor shall maintain his working place in safe condition; observe safety rules covering the handling and use of explosives; and while traveling through the mine to and from his working place observe all precaution and generally conform to the regulations of the mine.

(5) All work shall be done to the entire satisfaction of the Company's representative and should the Contractor fail to carry out the terms of this paragraph, the Company shall have the right of correcting the work itself or contracting it to other parties, and the cost of correcting this work shall be deducted from any amounts due the Contractor.

(6) The Contractor shall not misuse the tools and appliances of the Company, and should he fail to return them to the Company in good condition, reasonable wear and tear excepted, a reasonable charge, to be determined by the Company, for loss or breakage shall be deducted from the amounts due the Contractor.

(7) This contract is terminable at the option of the Company, and subject to the provisions of the last two preceding paragraphs, likewise at the option of the Contractor.

For the Company

Luis Cabrera, *H. A. Archer.*
Contractor.

---

[a] Convenient size, 8½ by 13 inches.

FORM 19.—*Form for tabulated report of contract work.*[a]

AMERICAN MINING CO.

Mine contracts for ½ *month* ending *August 31*, 1918.

Contr. No.	Working place.	Total distance or cars.	Advance for period.	Price per foot or car.	Amount.	Contractor's expense.			Balance due.	Remarks.
						Labor.	Supplies.	Total.		
5	*4th level E.*	*121*	*37*	*$16.00*	*$592.00*	*$301.40*	*$209.18*	*$510.58*	*$81.42*	
9	*Stope 316.*	*916*	*403*	*.80*	*322.40*	*166.32*	*98.78*	*265.10*	*57.30*	

[a] Convenient size 8½ by 10 inches.

PAY ACCOUNTS.

PAY ROLLS.

The time of the men as reported at the office is posted daily to the pay rolls (Form 20), one or more sheets being used for each department. Pay rolls are usually closed monthly or half-monthly; their correctness is certified to by the man in charge of the department. It will be noted that in Form 20 the space occupied by "names" is subdivided into fifths in the columns "occupation" to "amount," inclusive. This arrangement is for convenience in distributing costs and permits distribution of a man's work under five different account numbers in any one month, if desired. This distribution can be used independently or as a check on the distribution made from the time cards. Where the mechanical department is carried as a clearing account, the distribution of mechanics' time is made wholly from the time cards and the mechanics are merely carried as such on the pay roll.

The pay roll shows the earnings and deductions with balance due of all men, including salaried employees. Where cash advances are given, or men are paid off (time checks) during the month, these payments are entered on the day of issue.

t 31, 1918.

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FORM 21.—*Form for time check.*[a]

AMERICAN MINING CO.

Time Check.

No. *116*. *Sept. 10*, 191*8*.

Issued to *George Carter*.

Why issued: *Discharged for carelessness.*

....

....

....

AMERICAN MINING CO.

Time Check.

No. *116*. *Sept. 10*, 191*8*.

Pay *George Carter* .... *Amount due.*

Worked this day 1/2 shifts. Why issued: *Discharged for carelessness.*

H. Franklin,
Foreman.

Roll No. *4*. Mo. *Sept.*, 191*8*. Chk'd *F. M. Nash,*
Timekeeper.

Amount paid, *$19.40*. Rec'd payment, *George Carter,*
Employee.

Shifts.	Rate.	Amount.
8 1/2	*$4.40*	*$35.20*

Earnings.................. *$35.20*
Deductions.............. *16.00*
Amount paid........... *19.20*

---

[a] Bound in pads or flexible book form; convenient size; stub 3 by 3 inches; check 3 by 7 inches.

TIME CHECKS.

Time checks (Form 21) are issued when a man is discharged or where, for special reasons, an immediate final settlement is warranted.

COUPON BOOKS.

Where the mine operates a commissary or store, coupon books having a specific face value, but not transferable, are issued as warranted. They are exchangeable for goods at the commissary and their face value is charged to the operative.

PAY STATEMENTS.

At many mines protests by employees that their time has not been properly kept or their pay is short is a fruitful source of vexation. If the records are in order, settlements should be capable of rapid verification or correction. The best method of avoiding disputes is to give the employee a detailed statement of the amount of his earnings with any deductions therefrom, and allow him time to consider it before receiving his money. Form 22 meets this requirement. A statement is handed the employee; if correct he signs and passes it to the paymaster and receives his pay envelope, on the face of which is a carbon copy of the statement. The result is that the company retains a receipt for the payment, and the employee a copy of the statement that he has signed.

FORM 22.—*Form for statement of earnings and amount of pay due.*

TIME STATEMENT.[a]

.... No. ....

In account with

AMERICAN MINING CO.

..............................for....................

Earnings.

By .... shifts at $....................	......	......
By .... shifts at $....................	......	......
By .... shifts at $....................	......	......
By .... shifts at $....................	......	......
By....................................	......	......
By....................................	......	......
By....................................	......	......
Total earnings..................	......	......

Charges.

For doctor..............	......	......	......	......
For board..............	......	......	......	......
For room rent..........	......	......	......	......
For store..............	......	......	......	......
For....................	......	......	......	......
For....................	......	......	......	......
For....................	......	......	......	......
For cash advanced......	......	......	......	......
Total charges......	......	......	......	......
Balance as per pay roll..........	......	......	......	......

Received payment in full for the above services.

....

(Sign here)

Not negotiable.

PAY ENVELOPE.[b]

.... No. ....

In account with

AMERICAN MINING CO.

..............................for....................

Earnings.

By .... shifts at $....................	......	......
By .... shifts at $....................	......	......
By .... shifts at $....................	......	......
By .... shifts at $....................	......	......
By....................................	......	......
By....................................	......	......
By....................................	......	......
Total earnings..................	......	......

Charges.

For doctor..............	......	......	......	......
For board..............	......	......	......	......
For room rent..........	......	......	......	......
For store..............	......	......	......	......
For....................	......	......	......	......
For....................	......	......	......	......
For....................	......	......	......	......
For cash advanced......	......	......	......	......
Total charges......	......	......	......	......
Balance as per pay roll..........	......	......	......	......

[a] In pads; convenient size, 3½ by 7 inches.

[b] Paper envelopes opening at top, convenient size, 3½ by 7 inches. This statement, on the face of the envelope, is filled in as carbon copy of "Time statement."

SUPPLEMENTARY STATEMENTS.

The foregoing is intended only to furnish a skeleton outline of cost-keeping methods applicable to small and medium sized properties. That the methods and forms presented must be modified and amplified to suit the requirements of individual mines is a foregone conclusion. If they furnish a basis from which a suitable cost-keeping system may be developed they will have served their purpose.

At most mines departmental cost sheets, which give the same information in different form, will probably be developed. One such cost sheet has been shown (see Form 3, on pages 19–20). The only suggestion offered here is that where possible the departmental statements should be so arranged that the expenditures will drain automatically into whatever form of final cost statement is employed. This, of course, becomes increasingly difficult, as operations expand and become more involved. At large properties, much detail is shown on all cost accounts, and a large office force is required to prepare the desired information.

The scheme herein suggested for distributing expenditures can readily be modified to cover construction accounts. A sharp distinction should be made between operating and capital expenditure (construction accounts) at all times.

The forms offered deal without exception with costs and contributory data. In addition, however, it will be found at any well-managed mine that tabulated records of operations are required. There will be survey records which may involve the usual mine maps, supplemented by assay plans, stope sheets, the collecting and plotting of geological data; sampling and assay records must be kept in order for reference; a record must be kept of the milling or smelting performance if such exists; and many analyses of underground and power operations will no doubt be required. Standardization of records can be obtained by using forms for these and similar purposes. The collection and preparation of these records, while expensive, enables the management to keep in close touch with all features of the business.

A few forms that have been found useful at properties of moderate size are submitted herewith. Form 23 is used for reporting withdrawals from the timber and lumber stocks. Form 24 covers withdrawal of explosives. Form 25 may be used for the purpose of recording assays of samples from mine workings; it might supplement assay plans. Form 26 may be found convenient at mines where it is desirable to sample mine cars coming from various working faces. Besides furnishing data as to the grade of ore from distinct localities underground, this record serves as a check on the mill-feed returns. The use of this form implies that grab sampling of cars gives reasonably accurate results.

FORM 23.—*Form for reporting withdrawals from timber and lumber stocks.*[a]

AMERICAN MINING CO.

TIMBER REPORT.

Shift, *day.* Date, *Sept. 9, 1918.*

Working place.	Round timber.		Lumber.			Wedges.	Account.
	Length.	Diameter.	Pieces.	Size.	Length.		
Slope 265	*60 ft.*	*10″*				*10*	*31*
Chute 413			*4*	*10×10*	*14 ft.*		*31*
			8	*2×10*	*10 ft.*		*31*
6th level west	*30 ft.*	*10″*				*10*	*81*

Foreman, *H. Franklin.*

FORM 24.—*Form for reporting withdrawal of explosives from warehouse stocks.*[a]

AMERICAN MINING CO.

EXPLOSIVES REPORT.

Shift, *day.* Date, *Sept. 9, 1918.*

Working place.	Dynamite.		Fuse, feet.	Caps, number.	Charge account.
	Sticks.	Size.			
Stope 265	*50*	*1″*	*100*	*15*	*11*
4th level west	*40*	*1″*	*90*	*10*	*61*

Foreman, *H. Franklin.*

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[a] In pads, convenient size 5 by 8½ inches.

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Form 25.—*Form for recording assays of samples from workings.*[a]

Lead at *8*c per pound.

Silver at *100*c per ounce.

AMERICAN MINING CO.

SAMPLING RECORD.

Name of working *5th level east.* Month of *Sept.*, 191*8*.

Sample No.	Date sampled.	Location.	Width, feet.	Value per ton.			Foot dollars.	Remarks.
				Lead, per cent.	Silver, ounces.	Dollars.		
713	*1*	*55′ E. Winze 518..*	*4.2*	*4.4*	*10.1*	*17.14*	*72.0*	
742	*3*	*55′.....do........*	*5.0*	*6.2*	*8.7*	*18.62*	*93.1*	
751	*4*	*60′.....do........*	*5.2*	*3.8*	*8.1*	*14.18*	*73.7*	
774	*7*	*65′.....do........*	*4.1*	*2.2*	*12.0*	*15.52*	*63.6*	
	Carry forward..........		.....	....		.....	.....	....
	Totals and averages........		.....	....		.....	.....	....

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[a] Convenient size 10 by 12 inches.

Form 26.—*Form for car sampling record.*[a]

Lead at *8*c per pound.

Silver at *100*c per ounce.

AMERICAN MINING CO.

Car Sampling Record.

Cars from *Chutes 316–324.* Month of *Sept.*, 191*8*

Date.	Number of cars.		This day—value per ton.			Car dollars.		Average value per ton to date. (dollars).
	This day.	Total to date.	Lead, per cent.	Silver, ounces.	Dollars.	This day.	Total to date.	
1	*40*	*40*	*6.7*	*14.1*	*24.82*	*992.8*	*992.8*	*24.82*
2	*34*	*74*	*4.1*	*9.7*	*17.26*	*586.8*	*1589.6*	*21.47*
3	*45*	*119*	*3.6*	*13.0*	*18.76*	*744.2*	*2333.8*	*19.60*
29								
30								
31								

---

[a] Convenient size 6½ by 13 inches.

As the enterprise grows the management can not maintain personal contact with all its phases, and the importance of departmental reports becomes increasingly evident. The requirements of the property must be the determining factor in this matter of collecting and presenting data, and the general scheme and forms must be created with due regard to the particular problem in hand. Therefore, no attempt will be made herein to deal further with this feature.

DEPLETION AND DEPRECIATION.

All mines are wasting assets. A successful mine is required therefore to return the investment plus adequate interest over the period of distribution. As a mine approaches exhaustion, both the original property and the improvements—which when combined presumably represent the investment—have materially decreased in value. Depletion plus depreciation are charges that have been withheld from profits for the purpose of meeting the decrease in value.

DEPLETION.

Depletion has to do with the decline in value of the mining lands due to the extraction, and consequent exhaustion, of the commercially recoverable mineral content. The value of mining lands less their mineral content is usually small. The determination of the rate of depletion implies an estimate of the life of the mining undertaking—a consideration which is usually surrounded with uncertainties. Usually a conservative assumption is desirable, because the uncertainties of mining investments are proverbial. The more speculative the type of mine the more drastic should be the depletion charge. The annual rate of depletion may properly be modified from time to time as conditions change.

A fund may be set aside from earnings to meet this reserve for depletion. This fund has been known to be (*a*) invested in high-grade securities to be liquidated and distributed among shareholders when the affairs of the company are wound up; (*b*) carried as a reserve for the purchase of new properties in an endeavor to perpetuate the enterprise; (*c*) distributed among shareholders from time to time as a return of capital and as distinct from dividends.

DEPRECIATION.

Depreciation represents the decline in value of such capital assets as machinery, plant, buildings, equipment, and mine workings. The main expenditure on account of these items is usually incurred before the mine starts to yield a profit, but additional expenditures for such items are generally made during the whole operating period.

It is not usual to find a mine where all of these items can consistently be assumed to have the same life, and something in the nature of an individual assessment is usually necessary. But estimates of the life of these items may be influenced by the prospective life of the property, as well as by the probable period of usefulness of the particular item under consideration.

The salvage value of improvements at an exhausted mine is usually relatively small.

The disposition of funds withheld from profits for purposes of meeting depreciation charges may be similar to the procedure discussed under depletion.

ACCOUNTING.

The details of mine accounting are not within the scope of this discussion. Commercial accounting methods apply to mines as well as factories, and they should be adapted to the requirements of the problem in hand.

PUBLICATIONS ON METAL MINING.

A limited supply of the following publications of the Bureau of Mines has been printed and is available for free distribution until the edition is exhausted. Requests for all publications can not be granted, and to insure equitable distribution applicants are requested to limit their selection to publications that may be of especial interest. Requests for publications should be addressed to the Director, Bureau of Mines.

The Bureau of Mines issues a list showing all its publications available for free distribution as well as those obtainable only from the Superintendent of Documents, Government Printing Office, on payment of the price of printing. Interested persons should apply to the Director, Bureau of Mines, for a copy of the latest list.

PUBLICATIONS AVAILABLE FOR FREE DISTRIBUTION.

BULLETIN 48. The selection of explosives used in engineering and mining operations, by Clarence Hall and S. P. Howell. 1914. 50 pp., 3 pls., 7 figs.

BULLETIN 57. Safety and efficiency in mine tunneling, by D. W. Brunton and J. A. Davis. 1914. 271 pp., 6 pls., 45 figs.

BULLETIN 62. National mine rescue and first-aid conference, Pittsburgh, Pa., September 23–26, 1912, by H. M. Wilson. 1913. 74 pp.

BULLETIN 74. Gasoline mine locomotives in relation to safety and health, by O. P. Hood and R. H. Kudlich, with a chapter on methods of analyzing exhaust gases, by G. A. Burrell. 1915. 84 pp., 3 pls., 27 figs.

BULLETIN 75. Rules and regulations for metal mines, by W. R. Ingalls and others. 1915. 296 pp., 1 fig.

BULLETIN 80. A primer on explosives for metal miners and quarrymen, by C. E. Munroe and Clarence Hall. 1915. 125 pp., 51 pls., 17 figs.

BULLETIN 90. Abstracts of current decisions on mines and mining, December, 1913, to September, 1914, by J. W. Thompson. 1915. 176 pp.

BULLETIN 101. Abstracts of current decisions on mines and mining, October, 1914, to April, 1915, by J. W. Thompson. 1915. 138 pp.

BULLETIN 105. Black damp in mines, by G. A. Burrell, I. W. Robertson, and G. G. Oberfell. 1916. 92 pp.

BULLETIN 118. Abstracts of current decisions on mines and mining, reported from October to December, 1915, by J. W. Thompson. 1916. 74 pp.

BULLETIN 126. Abstracts of current decisions on mines and mining, reported from January to April, 1916, by J. W. Thompson. 1916. 90 pp.

BULLETIN 132. Siliceous dust in relation to pulmonary disease among miners in the Joplin district, Missouri, by Edwin Higgins, A. J. Lanza, F. B. Laney, and G. S. Rice. 1917. 116 pp., 16 pls., 6 figs.

BULLETIN 139. Control of hookworm infection at the deep gold mines of the Mother Lode, California, by J. G. Cumming and J. H. White. 1917. 52 pp., 1 pl., 5 figs.

BULLETIN 143. Abstracts of current decisions on mines and mining, reported from May to August, 1916, by J. W. Thompson. 1917. 72 pp.

BULLETIN 152. Abstracts of current decisions on mines and mining, reported from January to April, 1917, by J. W. Thompson. 1917. 78 pp.

BULLETIN 153. The mining industry in the Territory of Alaska during the calendar year 1916, by Sumner S. Smith. 1917. 91 pp., 1 pl.

TECHNICAL PAPER 4. The electrical section of the Bureau of Mines, its purpose and equipment, by H. H. Clark. 1911. 12 pp.

TECHNICAL PAPER 11. The use of mice and birds for detecting carbon monoxide after mine fires and explosions, by G. A. Burrell. 1912. 15 pp.

TECHNICAL PAPER 13. Gas analysis as an aid in fighting mine fires, by G. A. Burrell and F. M. Seibert. 1912. 16 pp., 1 fig.

TECHNICAL PAPER 19. The factor of safety in mine electric installations, by H. H. Clark. 1912. 14 pp.

TECHNICAL PAPER 30. Mine-accident prevention at Lake Superior iron mines, by D. E. Woodbridge. 1913. 38 pp., 9 figs.

TECHNICAL PAPER 58. Action of acid mine water on the insulation of electrical conductors, a preliminary report, by H. H. Clark and L. C. Ilsley. 1913. 26 pp., 1 fig.

TECHNICAL PAPER 59. Fires in Lake Superior iron mines, by Edwin Higgins. 1913. 34 pp., 2 pls.

TECHNICAL PAPER 62. Relative effects of carbon monoxide on small animals, by G. A. Burrell, F. M. Seibert, and I. W. Robertson. 1914. 23 pp.

TECHNICAL PAPER 82. Oxygen mine rescue apparatus and physiological effects on users, by Yandell Henderson and J. W. Paul. 1917. 102 pp., 5 pls., 6 figs.

TECHNICAL PAPER 95. Mining and milling of lead and zinc ores in the Wisconsin district, Wisconsin, by C. A. Wright. 1915. 39 pp., 2 pls., 5 figs.

TECHNICAL PAPER 103. Organizing and conducting safety work in mines, by H. M. Wilson and J. R. Fleming. 1917. 57 pp., 35 figs.

TECHNICAL PAPER 105. Pulmonary disease in the Joplin district, Missouri, and its relation to rock dust in the mines, by A. J. Lanza and Edwin Higgins. 1915. 48 pp., 5 pls., 4 figs.

TECHNICAL PAPER 112. The explosibility of acetylene, by G. A. Burrell and G. G. Oberfell. 1915. 15 pp.

TECHNICAL PAPER 122. Effects of oxygen deficiency in small animals and on men, by G. A. Burrell and G. G. Oberfell. 1915. 12 pp.

TECHNICAL PAPER 132. Underground latrines for mines, by J. H. White. 1916. 23 pp., 2 pls., 7 figs.

TECHNICAL PAPER 134. Explosibility of gases from mine fires, by G. A. Burrell and G. G. Oberfell. 1916. 31 pp., 1 fig.

TECHNICAL PAPER 174. Suggestions for the safe operation of gasoline engines in mines, by R. H. Kudlich and Edwin Higgins. 1917. 19 pp., 3 figs.

MINERS' CIRCULAR 5. Electrical accidents in mines, their causes and prevention, by H. H. Clark, W. D. Roberts, L. C. Ilsley, and H. F. Randolph. 1911. 10 pp., 3 pls.

MINERS' CIRCULAR 10. Mine fires and how to fight them, by J. W. Paul. 1912. 14 pp.

MINERS' CIRCULAR 11. Accidents from mine cars and locomotives, by L. M. Jones. 1912. 16 pp.

MINERS' CIRCULAR 13. Safety in tunneling, by D. W. Brunton and J. A. Davis. 1913. 19 pp.

MINERS' CIRCULAR 17. Accidents from falls of rock and ore, by Edwin Higgins. 1914. 15 pp., 8 figs.

MINERS' CIRCULAR 18. Notes on miners' carbide lamps, by J. W. Paul. 1915. 11 pp.

MINERS' CIRCULAR 19. The prevention of accidents from explosives in metal mining, by Edwin Higgins. 1914. 16 pp., 11 figs.

MINERS' CIRCULAR 23. Elementary first aid for the miner, by W. A. Lynott and D. Harrington. 1916. 24 pp., 19 figs.

Rescue and recovery operations in mines after fires and explosions, by J. W. Paul and H. M. Wolflin. 1916. 109 pp.

Advanced first-aid instructions for miners, a report on standardization, by a committee of surgeons; G. H. Halberstadt, A. F. Knoefel, W. A. Lynott, W. S. Rountree, and M. J. Shields. 1917. 142 pp., 65 figs.

PUBLICATIONS THAT MAY BE OBTAINED ONLY THROUGH THE SUPERINTENDENT OF DOCUMENTS.

BULLETIN 53. Mining and treatment of feldspar and kaolin in the Southern Appalachian region, by A. S. Watts. 1913. 170 pp., 16 pls., 12 figs. 35 cents.

BULLETIN 61. Abstracts of current decisions on mines and mining, October, 1912, to March, 1913, by J. W. Thompson. 1913. 82 pp. 10 cents.

BULLETIN 79. Abstracts of current decisions on mines and mining, March to December, 1913, by J. W. Thompson. 1914. 140 pp. 20 cents.

BULLETIN 94. United States mining statutes annotated, by J. W. Thompson. 1915. 1772 pp. In two parts, not sold separately. Cloth, $2.50 per set; paper, $2.00.

BULLETIN 107. Prospecting and mining of copper ore at Santa Rita, N. Mex., by D. F. MacDonald and Charles Enzian. 1916. 122 pp., 10 pls., 20 figs. 25 cents.

BULLETIN 111. Molybdenum; its ores and their concentration, with a discussion of market, prices, and uses, by F. W. Horton. 1916. 132 pp., 18 pls., 2 figs. 30 cents.

BULLETIN 113. Abstracts of current decisions on mines and mining, reported from May to September, 1915, by J. W. Thompson. 1916. 124 pp. 15 cents.

BULLETIN 121. The history and development of gold dredging in Montana, by Hennen Jennings, with a chapter on placer-mining methods and operating costs, by Charles Janin. 1916. 64 pp., 29 pls., 1 fig. 30 cents.

BULLETIN 147. Abstracts of current decisions on mines and mining, reported from September to December, 1916, by J. W. Thompson. 1917. 84 pp. 10 cents.

TECHNICAL PAPER 17. The effect of stemming on the efficiency of explosives, by W. O. Snelling and Clarence Hall. 1912. 20 pp., 11 figs. 5 cents.

TECHNICAL PAPER 24. Mine fires, a preliminary study, by G. S. Rice. 1912. 51 pp., 1 fig. 5 cents.

TECHNICAL PAPER 29. Training with mine-rescue breathing apparatus, by J. W. Paul. 1912. 16 pp. 5 cents.

TECHNICAL PAPER 41. The mining and treatment of lead and zinc ores in the Joplin district, Mo., a preliminary report, by C. A. Wright, 1913. 43 pp., 5 figs. 5 cents.

TECHNICAL PAPER 67. Mine signboards, by Edwin Higgins and Edward Steidle. 1913. 15 pp., 1 pl., 4 figs. 5 cents.

TECHNICAL PAPER 77. Report of the Committee on Resuscitation from Mine Gases, by W. B. Cannon, G. W. Grile, Joseph Erlanger, Yandell Henderson, and S. J. Meltzer. 1914. 35 pp., 4 figs. 5 cents.

MINERS' CIRCULAR 4. The use and care of mine-rescue breathing apparatus, by J. W. Paul. 1911. 24 pp., 5 figs. 5 cents.

MINERS' CIRCULAR 15. Rules for mine-rescue and first-aid field contests, by J. W. Paul. 1913. 12 pp. 5 cents.

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